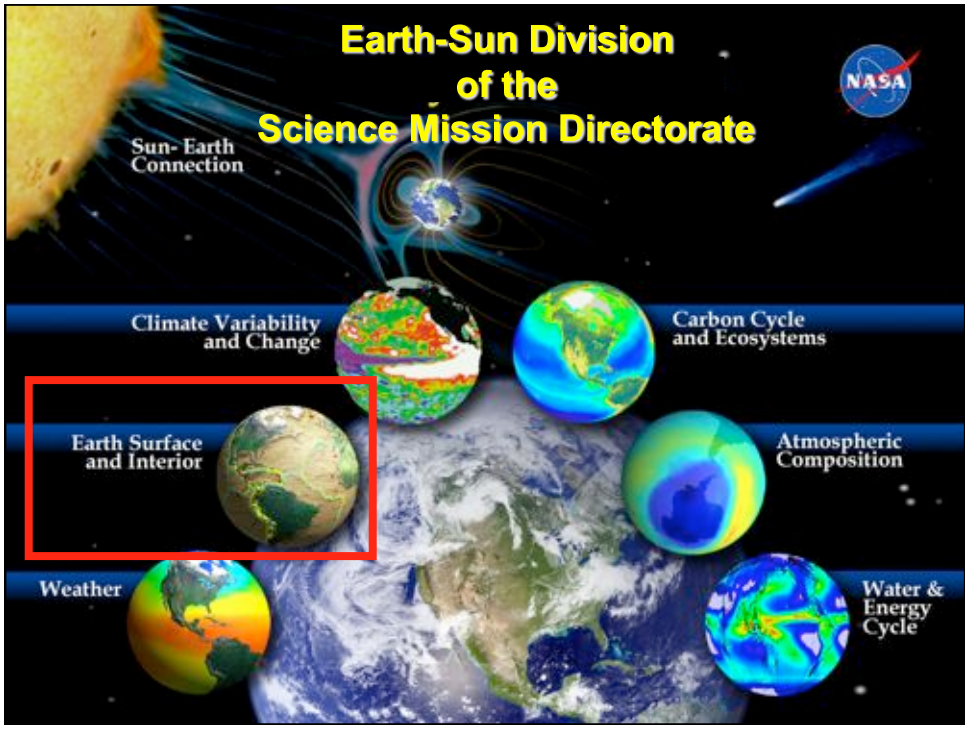
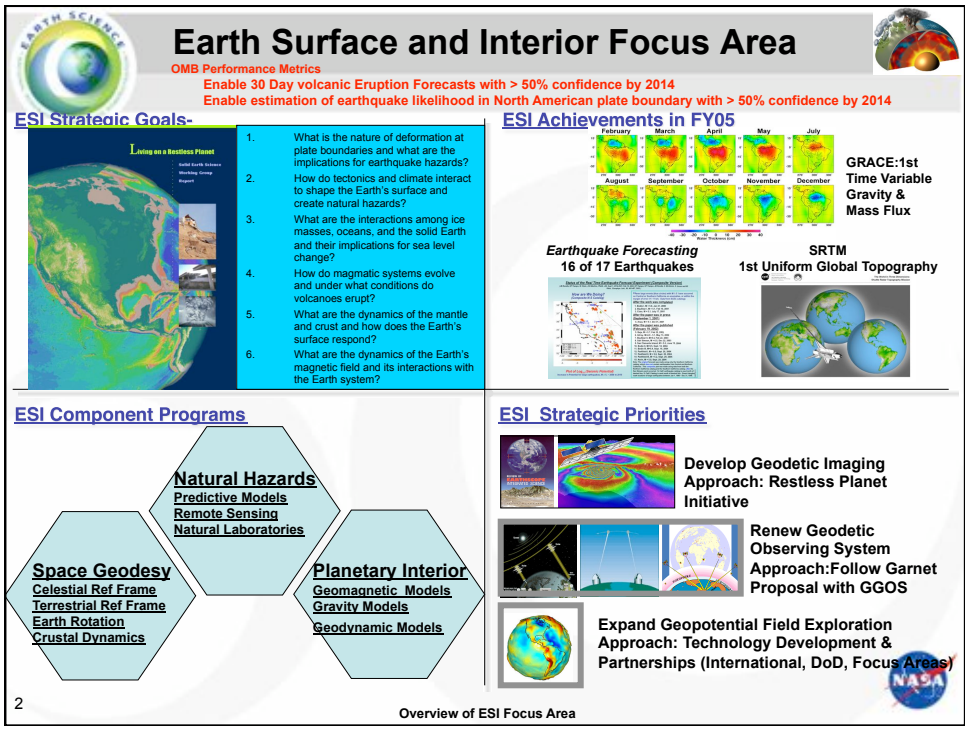
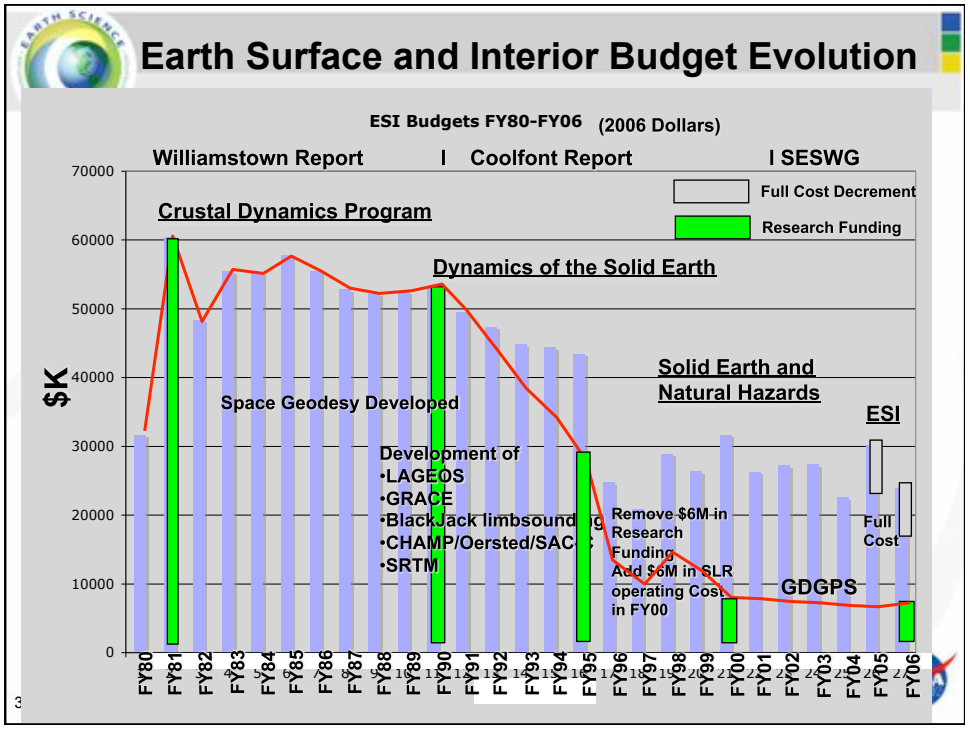

Earth-Sun Division
of the
Science Mission Directorate
NASA
Sun- Earth
Connection
Climate Variability
and Change
Carbon Cycle
and Ecosystems
Earth Surface
and Interior
Atmospheric
Composition
Weather
Water &
Energy
Cycle


Earth Surface and Interior Focus Area
OMB Performance Metrics
Enable 30 Day volcanic Eruption Forecasts with > 50% confidence by 2014
Enable estimation of earthquake likelihood in North American plate boundary with > 50% confidence by 2014
ESI Strategic Goals-
1. What is the nature of deformation at plate boundaries and what are the implications for earthquake hazards?
2. How do tectonics and climate interact to shape the Earth's surface and create natural hazards?
3. What are the interactions among ice masses, oceans, and the solid Earth and their implications for sea level change?
4. How do magmatic systems evolve and under what conditions do volcanoes erupt?
5. What are the dynamics of the mantle and crust and how does the Earth's surface respond?
6. What are the dynamics of the Earth's magnetic field and its interactions with the Earth system?
ESI Achievements in FY05
GRACE:1st Time Variable Gravity & Mass Flux
Earthquake Forecasting
16 of 17 Earthquakes
SRTM
1st Uniform Global Topography
ESI Component Programs
Natural Hazards
Predictive Models
Remote Sensing
Natural Laboratories
Space Geodesy
Celestial Ref Frame
Terrestrial Ref Frame
Earth Rotation
Crustal Dynamics
Planetary Interior
Geomagnetic Models
Gravity Models
Geodynamic Models
ESI Strategic Priorities
Develop Geodetic Imaging Approach: Restless Planet Initiative
Renew Geodetic Observing System Approach:Follow Garnet Proposal with GGOS
Expand Geopotential Field Exploration Approach: Technology Development & Partnerships (International, DoD, Focus Areas)
2
Overview of ESI Focus Area


Earth Surface and Interior Budget Evolution
ESI Budgets FY80-FY06 (2006 Dollars)
Williamstown Report
Coolfont Report
SESWG
Full Cost Decrement
Research Funding
Crustal Dynamics Program
Dynamics of the Solid Earth
Solid Earth and Natural Hazards
ESI
Space Geodesy Developed
Development of
•LAGEOS
•GRACE
•BlackJack limbsounding
•CHAMP/Oersted/SAC
•SRTM
Remove $6M in Research Funding
Add $6M in SLR operating Cost in FY00
GDGPS
Full Cost
$K
70000
60000
50000
40000
30000
20000
10000
0
FY80
FY81
FY82
FY83
FY84
FY85
FY86
FY87
FY88
FY89
FY90
FY91
FY92
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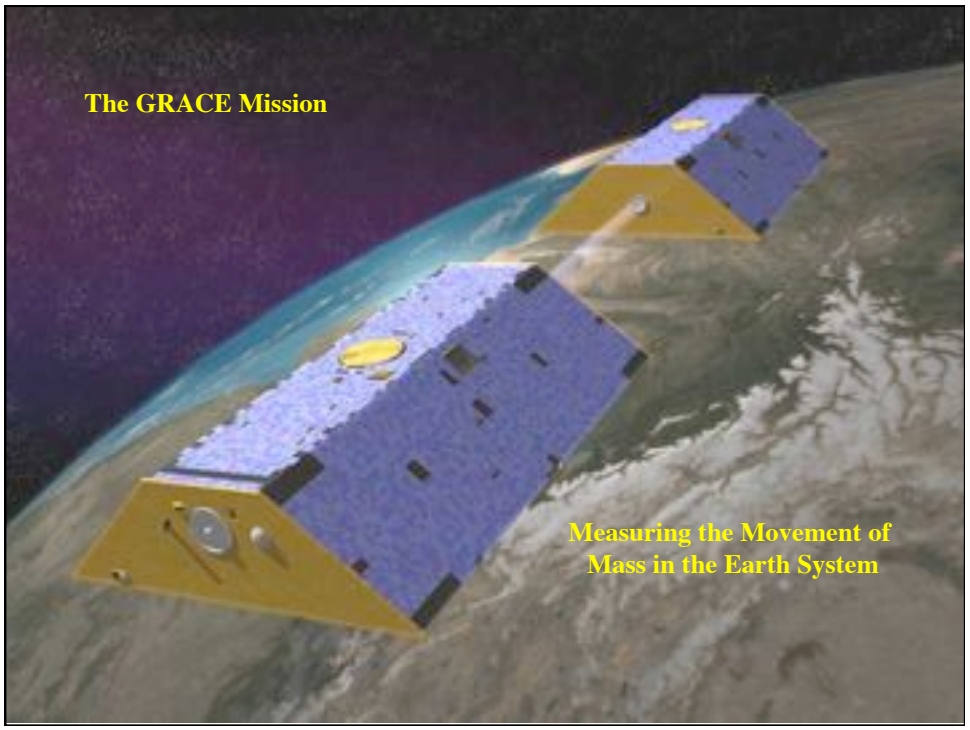
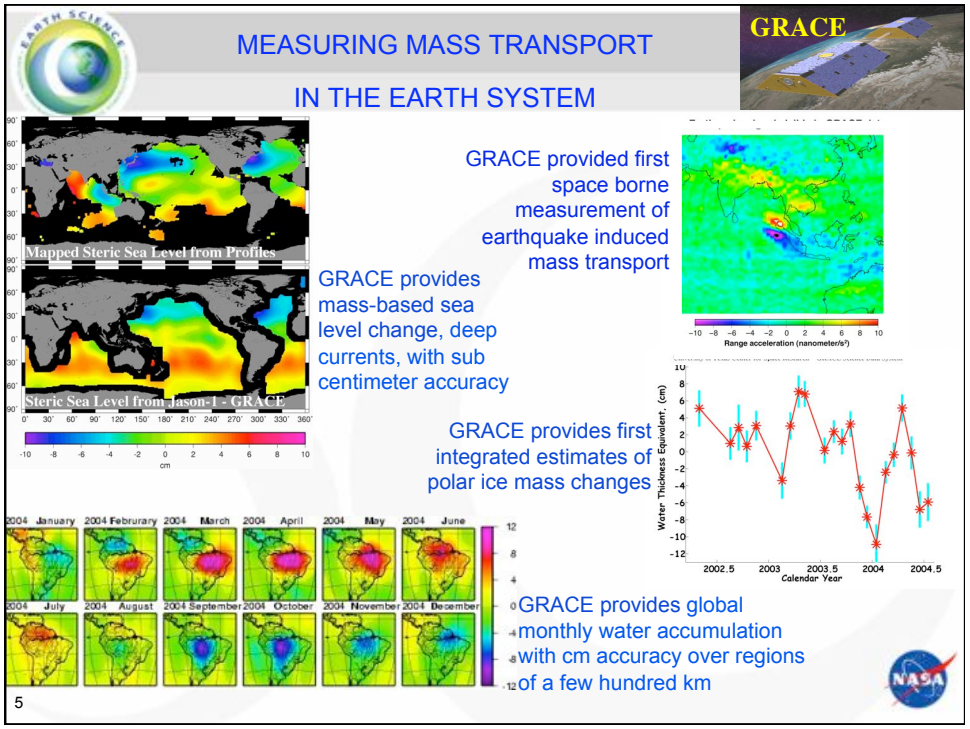
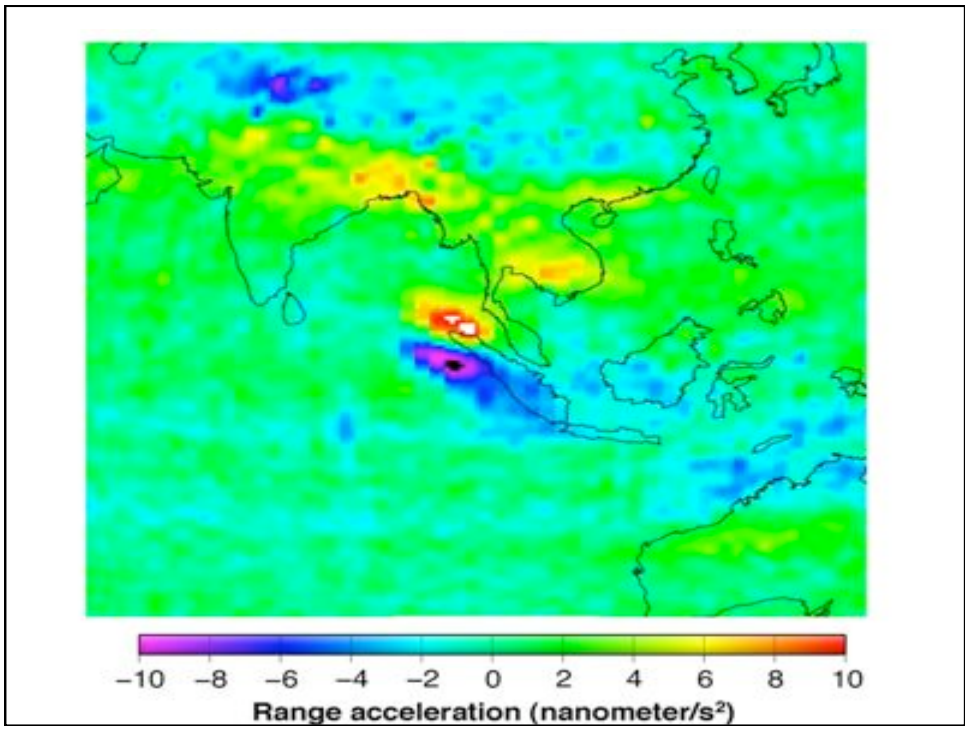
FY00
FY01
FY02
FY03
FY04
FY05
FY06


The GRACE Mission
Measuring the Movement of Mass in the Earth System


MEASURING MASS TRANSPORT
IN THE EARTH SYSTEM
GRACE
Mapped Steric Sea Level from Profiles
Steric Sea Level from Jason-1 - GRACE
cm
GRACE provides mass-based sea level change, deep currents, with sub centimeter accuracy
GRACE provided first space borne measurement of earthquake induced mass transport
Range acceleration (nanometer/s²)
GRACE provides first integrated estimates of polar ice mass changes
Water Thickness Equivalent, (cm)
Calendar Year
2004 January
2004 February
2004 March
2004 April
2004 May
2004 June
2004 July
2004 August
2004 September
2004 October
2004 November
2004 December
GRACE provides global monthly water accumulation with cm accuracy over regions of a few hundred km
5


−10 −8 −6 −4 −2 0 2 4 6 8 10
Range acceleration (nanometer/s²)

Jet Propulsion Laboratory
California Institute of Technology

QUAKESIM

Objectives·
Develop a solid Earth science framework in order to better understand active tectonic and earthquake processes·Construct a fully interoperable system of tools for studying these processes.

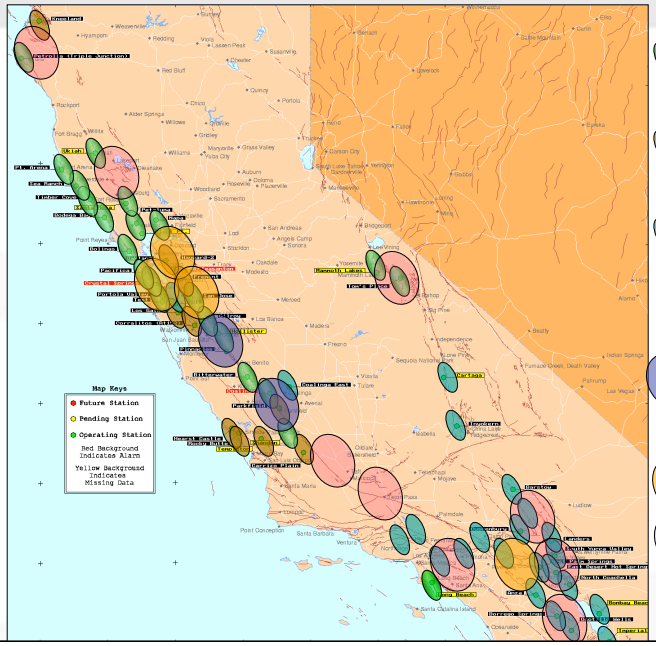
GeoFEST uses stress-displacement finite elements to model stress and flow in a realistic model of the Earth's crust and upper mantle in a complex region such as the Los Angeles Basin.

PARK is a boundary element program that determines the stress on every element of the fault surface due to slip on every other element, using a Green's function approach.

Virtual California is a code that utilizes the Monte Carlo method in order to generate simulated, realistic earthquakes on an arbitrary fault surface mesh.

7

QF1005 Planned Locations



Existing Sites

High School
•3 axis mag.

QF-1000
•3 axis mag.

QF-1003
•3 axis mag.
•GPS
•GlobalStar
•Air Conduct.
•Geophone

Berkeley

Future Sites

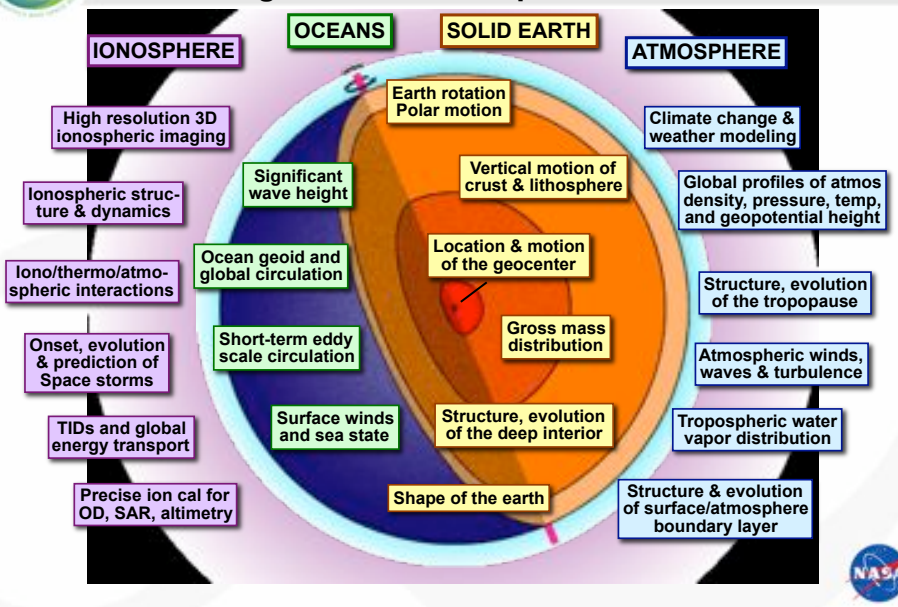
Stanford (2005)

QF-1005 (2005)

QF-1005 Portable

8

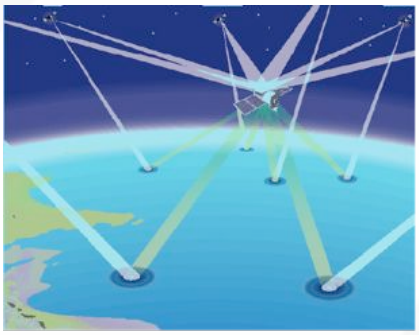
Probing the Earth with Spaceborne GPS



9

GNSS Remote Sensing Concept

- Constellation of GNSS satellites
  - GPS
  - GALILEO
  - Others
- Constellation of GNSS receivers in LEO
  - 6 LEO
  - High gain nadir antennas
    - 1-2 meter diameter electronically steerable antenna
- Receivers track phase delay of GNSS signals
  - Direct signals
  - Reflected signals from the ocean
- Continuous acquisition of reflections
  - on an increasingly dense, pseudo-random grid
- Recover ocean surface heights
  5 – 25 cm



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